SHOOTING SYSTEM FOR VISIBLY DISPLAYING
HIT POINT OF OPTICAL BULLET ON TARGET

Background of the Invention

5   1. Field of the Invention:

The present invention relates to a shooting system for displaying hit points of optical bullets on a target, and a display device associated therewith.

2. Description of the Related Art:

10   The shooting is conventionally known as one of sporting events. Recently, there have been proposed shooting systems in which live bullets or optical bullets are shot from a real gun or a ray gun toward a target which is to be shot for competing in score in accordance with a hit accuracy on the target (see, for example, Japanese Patent Laid-open Publication No.

15   303997/96).

As illustrated in Fig. 1, this exemplary conventional shooting system comprises laser gun 71 for emitting optical bullet 72 formed of laser light in response to a manipulation of a player; hit point detector 74 with a target plate 73 removably mounted thereon, on which optical bullets 72 emitted

20   from laser gun 71 hit, for detecting the positions on target plate 73 at which optical bullets 72 hit; player PC (Personal Computer) 75 for displaying hit points of optical bullets 72 on target plate 73 based on the result of a detection on hit point detector 74; and switching unit 76 for connecting hit point detector 74 with player PC 75. It should be noted that laser gun 71 is

25   distance away from hit point detector 74 by a distance previously determined for a particular event (for example, by 10 m or 25 m), so that a type of target

plate 73 suitable for the distance is selectively mounted on hit point detector 74. Switching unit 76 in turn comprises a switching HUB of 10 Base-T LAN 77.

In the following, description will be made on a flow of processing when a shooting game is played in the shooting system configured as described above.

As a player performs a manipulation for causing optical bullet 72 to be emitted from laser gun 71, such as pulling the trigger of laser gun 71, with laser gun 71 oriented toward target plate 73, optical bullet 72 is emitted from laser gun 71. Here, a light source used for optical bullet 72 emitted from laser gun 71 may be, for example, a semiconductor laser oscillator element.

In a manner similar to a live bullet from a real gun, optical bullet 72 from laser gun 71 travels straight in the direction in which laser gun 71 is oriented after it is emitted from the muzzle of laser gun 71.

As optical bullet 72 emitted from laser gun 71 hits on target plate 73 mounted on hit point detector 74, hit point detector 74 detects the hit point, and transmits information of the position of the detected hit point to player PC 75 through switching unit 76.

Player PC 75 displays a (circular) bullet mark at the hit point of optical bullet 72 based on the position information transmitted thereto from hit point detector 74. In addition, player PC 75 displays the player's number, bullet number, score corresponding to the bullet number, total score, and the like. It should be noted that in this shooting system, either hit point detector 74 or player PC 75 calculates the score for the shooting.

As illustrated in Fig. 2, target plate 73 shown in Fig. 1 has nine annular areas and a circular area about center point O, which are partitioned

by ten concentric circles centered at center point O. These ten areas are defined as scoring areas, and optical bullet 72 hiting out of the scoring areas gets no point. In the scoring areas, a score given to optical bullet 72 hiting in the outermost annular area (area with "1" displayed therein) is set to one,

5 and the score is in increments of point as optical bullet 72 hits in a scoring area closer to center point O from the outermost area, with a score of ten points given to optical bullet 72 hiting in the central circular area. For calculating the score for shooting using such target plate 73, the center of target plate 73 and the center of a (circular) bullet mark are connected by a

10 straight line, and the score is determined by the point at which the straight line intersects with the outer diameter of the bullet mark.

In the conventional shooting system as described above, however, when the bullet mark of optical bullet 72 on the target plate 73 is displayed on player PC 75, the bullet mark, which has a size of approximately 0.5 cm

15 to 1.0 cm on target plate 73, is scaled down to an extent suitable for display on the screen size of player PC 75, so that the displayed bullet mark of optical bullet 72 is too small to view on player PC 75.

The bullet mark of optical bullet 72 is utilized for calculating a score in the calculation of the score when target plate 73 is used as mentioned above.

20 Therefore, if the bullet mark is enlarged or deformed for display with the intention to facilitate viewing the bullet mark on the screen, a score recorded by the bullet mark cannot be recognized from the image on the screen. In addition, when a large number of optical bullets 72 hit near the center of target plate 73, individual bullet marks of optical bullets 72 cannot be

25 distinguished from one another.

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Summary of the Invention

It is an object of the present invention to provide a shooting system and a display device which are capable of visibly displaying a hit point of an optical bullet without the need for deforming or enlarging a bullet mark of the optical bullet.

To achieve the above object, the shooting system of the present invention is characterized by including a ray gun for emitting an optical bullet, detecting means for detecting a hit point of the optical bullet on a target, and display means for simultaneously displaying first data indicative of a bullet mark at a hit point of the optical bullet on the target, set in a predetermined size and shape, and second data indicative of the position of the hit point of the optical bullet on the target, based on the result of a detection on detecting means.

According to the foregoing configuration, the hit point of the optical bullet can be visibly displayed by the second data without the need for enlarging or deforming the bullet mark of the optical bullet. Also, a score recorded by the bullet mark can be readily recognized from the image on the screen because the bullet mark need not be enlarged or deformed for display.

The position of the hit point of the optical bullet indicated by the second data may be at the center of the hit point or a score calculating point.

Also, the second data may be data which indicates the position of the hit point of the optical bullet on the target in a predetermined shape. For example, the shape of the second data may be any of an "x" mark, a "+" mark, and an arrow. Further, the second data may be blinked while it is displayed.

The first data in turn may be data indicative of the bullet mark which is

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set in a predetermined size and shape in accordance with a particular game event.

The above and other objects, features, and advantages of the present invention will become apparent from the following description with reference to the accompanying drawings which illustrate examples of the present invention.

Brief Description of the Drawings

Fig. 1 is a diagram illustrating the configuration of an exemplary conventional shooting system;

Fig. 2 is a diagram illustrating an exemplary target plate shown in Fig. 1;

Fig. 3 is a diagram illustrating the configuration of a shooting system according to one embodiment of the present invention;

Fig. 4A is a diagram illustrating an exemplary screen displayed on a player PC shown in Fig. 3, wherein hit points of optical bullets on a target plate are displayed on the screen;

Fig. 4B is a partially enlarged view of the target plate in Fig. 4A near the center thereof;

Fig. 5 is a diagram illustrating another exemplary screen displayed on the player PC shown in Fig. 3, wherein hit points of optical bullets on the target plate are displayed on the screen;

Fig. 6 is a diagram illustrating a further exemplary screen displayed on the player PC shown in Fig. 3, wherein hit points of optical bullets on the target plate are displayed on the screen;

Fig. 7 is a diagram illustrating, by way of example, an overall screen

displayed on the player PC shown in Fig. 3, wherein the positions of hit points of optical bullets on the target plate are displayed on the screen in a manner similar to Fig. 4A; and

Fig. 8 is a diagram illustrating the configuration of a shooting system according to another embodiment of the present invention.

Description of the Preferred Embodiments

As illustrated in Fig. 3, the shooting system according to this embodiment comprises laser gun 1 for emitting optical bullet 2 formed of laser light in response to a manipulation of a player; hit point detector 4 with target plate 3 removably mounted thereon, on which optical bullet 2 emitted from laser gun 1 hits, for detecting the position on target plate 3 at which optical bullet 2 hits; player PC 5, which is applied as a display device of the present invention, for displaying the hit point of optical bullet 2 on target plate 3 based on the result of a detection on hit point detector 4; and switching unit 6 for connecting hit point detector 4 to player PC 5. It should be noted that laser gun 1 is distance away from hit point detector 4 by a distance previously determined for a particular event (for example, by 10 m or 25 m), so that a type of target plate 3 suitable for the distance is selectively mounted on hit point detector 4. Switching unit 6 in turn comprises a switching HUB of 10 Base-T LAN 77.

As illustrated in Fig. 4, player PC 5 simultaneously displays a first data indicative of a bullet mark at a hit point of optical bullet 2 on target plate 3, and a second data in the shape of "x" mark indicative of the center of the hit point of optical bullet 2 on target plate 3, based on a detected hit point at which optical bullet 2 hits on hit point detector 4. It should be noted that the

position at which optical bullet 2 hits, indicated by the second data, is not limited to the center of the hit point, but may be any position within the hit point, for example, a score calculating point (a point at which a straight line connecting the center of target plate 3 to the center of the (circular) bullet

5 mark intersects with the outer diameter of the bullet mark), or the like. Also, the shape of the second data is not limited to the "x" mark, but may be any shape which can indicate the position of the hit point of optical bullet 2, such as the "+" mark shown in Fig. 5, an arrow shown in Fig. 6, or the like. In addition, the shape of the second data may be a simple point, or alternatively,

10 the aforementioned "x" mark, "+" mark, or arrow which may be blinked on the screen.

In the following, description will be made on a flow of processing in the shooting system configured as described above when a single or several players practice a shooting game. Assume herein that player PC 5

15 manages and administrates the progress of the game, and the like.

First, the player(s) selects one of game events such as a center fire pistol game, a sport pistol game, and the like on player PC 5.

In firing with live bullets, the target plate and bullet mark differ in size and shape from one game event to another. This is similarly applied to this

20 embodiment, so that the size and shape of target plate 3 and bullet mark are set in accordance with a game event selected on player PC 5, and a target based on thus set target plate 3 is displayed on the screen of player PC 5. The target displayed on the screen of player PC 5 is scaled as appropriate in accordance with the screen size of player PC 5. Subsequently, player PC 5

25 executes a program for controlling the progress of the game, thereby starting the practice for the game.

As the player performs a manipulation which causes optical bullet 2 to be emitted from laser gun 1, such as pulling the trigger of laser gun 1 or the like, with laser gun 1 oriented toward target plate 3, optical bullet 2 is emitted from laser gun 1. Here, a light source used for optical bullet 2 emitted from laser gun 1 may be, for example, a semiconductor laser oscillator element.

In a manner similar to a live bullet from a real gun, optical bullet 2 from laser gun 1 travels straight in the direction in which laser gun 1 is oriented after it is emitted from the muzzle of laser gun 1.

As optical bullet 2 emitted from laser gun 1 hits on target plate 3 mounted on hit point detector 4, hit point detector 4 detects the hit point, and transmits information of the position of the detected hit point to player PC 5 through switching unit 6.

As illustrated in Fig. 4, player PC 5 simultaneously displays the first data indicative of a bullet mark at the hit point of optical bullet 2 on target plate 3, and the second data in the shape of "x" mark indicative of the center of the hit point of optical bullet 2 on target plate 3 based on the position information transmitted thereto from hit point detector 4.

In this event, player PC 5 displays a target based on target plate 3 which has been set in accordance with the game event in a size appropriate to the screen size of player PC 5. Also, player PC 5 displays the first data indicative of a bullet mark, which has been set in accordance with the game event, in a size and a shape relative to the target. Therefore, even if the target is enlarged on the display of player PC 5, the enlargement will not damage the relationship between the size of the target and the size and shape of the bullet mark.

Also, not limited to the center of the hit point, player PC 5 may display

the position of the hit point of optical bullet 2, indicated by the second data, at

any position within the hit point of optical bullet 2, for example, a score

calculating point (a point at which a straight line connecting the center of

target plate 3 to the center of the (circular) bullet mark of optical bullet 2

5   intersects with the outer diameter of the bullet mark), or the like.   Further,

player PC 5 may modify the size and shape of the second data in

accordance with particular situations such as an enlarged display and the

like so that the second data is readily perceivable.   For example, when the

position of the bullet mark cannot be clearly viewed because the overall

10   target is displayed on player PC 5 as illustrated in Fig. 4A, player PC 5 may

extend the length of the "x" mark as compared with the bullet mark, so that

the position of the bullet mark is readily perceivable.   On the contrary, when

the target is enlarged on the screen to make the position of the bullet mark

perceivable to some extent as illustrated in Fig. 4B, player PC 5 may reduce

15   the length of the "x" mark as compared with the bullet mark, so that the

position of the bullet mark is readily perceivable.   Player PC 5 may display

the second data in any shape which can indicate the position of the hit point

of optical bullet 2, such as the "+" mark shown in Fig. 5, arrow shown in Fig.

6, or the like, not limited to the "x" mark.   In addition, player PC 5 may

20   display the second data as a simple point, or alternatively, the

aforementioned "x" mark, "+" mark, or arrow which may be blinked on the

screen.

Further, as illustrated in Fig. 7, player PC 5 displays data such as the

player's number, bullet number, score corresponding to this bullet number,

25   total score, and the like in addition to the data indicative of the hit points of

the optical bullets 2 on target plate 3.   Fig. 7 shows the result of shooting at

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the time the fifth shot has been made in the first series in a shooting game in which the player(s) emits optical bullets 2 five times in each of the first to sixth series. More specifically, in Fig. 7, player PC 5 displays data on each of optical bullets 2 emitted in the first series such as a bullet number, a score

5   determined by the position at which a straight line connecting the center of target plate 3 to the center of a (circular) bullet mark at the hit point intersects with the outer diameter of the bullet mark (labelled "Score"), a direction of the hit point viewed from center O of target plate 3 (labelled "Direction"), a score determined by the distance between the point on the outer diameter of the

10   bullet mark and the center of the target plate 3 (labelled "Detail"), and the like, in addition to data such as the player's number and player's name. In Fig. 7, a total score is calculated and displayed in a field labelled "Score". In this shooting system, either hit point detector 4 or player PC 5 is responsible for calculating the score of shooting.

15   While the foregoing embodiment has been described for an example in which the display device of the present invention is applied to player PC 5, the display device of the present invention can be applied to any device as long as it displays hit points of optical bullets 2 on target plate 3.

             For example, the display device of the present invention can be

20   applied to a projector, a monitor and the like when player PC 5 not only displays hit points of optical bullets 2 on target plate 3 on the screen thereof, but also is connected to the projector, monitor and the like to display the hit points of optical bullets 2 on such devices.

             Also, while the foregoing embodiment has been described for an

25   example in which a player(s) practices a game, the display device of the present invention can be effectively applied to a game meeting as well.

When a game meeting takes place, it is contemplated, for example, that referee PC 8 for refereeing to manage the progress of the game and the like, audience PC 9 for showing game situations for audience, server 10 for totalizing and managing scores, and the like are connected to switching unit 6, as illustrated in Fig. 8. When these devices display hit points of optical bullets 2 on target plate 3, the display device of the present invention can be applied to these devices. It should be noted that when a game meeting takes place, limitations should be imposed on information displayed on player PC 5, which is viewed by players, such that the information is not advantageous or disadvantageous to some players in the game.

Also, while the foregoing embodiment has been described for an example in which player PC 5 manages and administrates the progress of a game and the like, the aforementioned referee PC 8 or server 10 may intensively manage and administrate the game.

While preferred embodiments of the present invention have been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.

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